Order Number | | Serial Number | |

PRODUCT / TEST MANUAL

2H33K7

DEFINITE TIME UNDER FREQUENCY RELAY

Issue Level	Date	Summary of changes
D	26/11/1999	Initial issue.

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1. BROAD DESCRIPTION OF RELAY

The 2H33 is a digitally set definite time underfrequency relay utilising a crystal oscillator for both frequency measuring and time delay functions. Harmonics on the input are attenuated by an active bandpass filter, analog circuitry is also used to provide the undervoltage lockout function. The remaining circuitry is CMOS digital, both frequency level and time delay are set on thumbwheel switches mounted on the front dial of the unit. Operation of the output relay is flagged with a bistable magnetic disc flag and the output relay will self-reset if a digitally presettable number of "good" input cycles have occurred.

2. SPECIFICATION

General

Auxiliary Supply	82.5 - 150V DC (110/125V nominal)
Auxiliary Supply Burden	<10W at nominal input
Ambient Temperature Range	-5 deg to 55 deg C

Frequency

Operational Setting Range	15.00 to 22.50ms period
Accuracy	±.05% of setting
Repeatability	±.01ms
Hysteresis	<.05ms
Response Time	100ms approx.
Sensing Supply	110V AC nominal
Sensing Supply Burden	<2VA
Undervoltage Lockout	Preset at 50% of nominal

Timer

Operational Setting Range	.05 to 9.99 seconds.
Accuracy	±1% of setting +20ms/-0ms
Repeatability	<10ms
Reset Time	Internal DIL switch selection of from 1 to 9 "good" cycles to elapse before timer reset.

Contacts

Output Relay Contact Ratings

Make and Carry Continuously
3000 VA AC resistive with maximums of 660 Volt and 12 Amp
3000 VA DC resistive with maximums of 660 Volt and 12 Amp

Make and Carry of 0.5 Second
7500 VA AC resistive with maximums of 660 Volt and 30 Amp
7500 VA DC resistive with maximums of 660 Volt and 30 amp

AC Break Capacity
3000 VA AC resistive with maximums of 660 Volt and 12 Amp

2. SPECIFICATION (Cont)

DC Break Capacity (Amps)

Voltage			24V	48V	125V	250V
Resistive rating		a b	12 12	1.5 12	0.5 10	0.25 5
L/R=40mS	Maximum break	a b	12 30	1 15	0.4 5.5	0.2 3.5
	1K operations (N3 Rating)	b	12	12	5	2.5

a = Without magnetic blowouts b = With magnetic blowouts

* As tested by Powernet Yarraville laboratories in Victoria.

Operation Indicator

A hand resettable bistable magnetic disc flag is fitted to give a visual indication that the output relay has operated.

3. TEST EQUIPMENT REQUIRED

110 Volt DC Supply
110 Volt AC Supply
Digital Frequency Meter
Digital Voltmeter
Digital Storage Oscilloscope

4. ASSOCIATED DRAWINGS

169-033-207	Master Circuit Diagram
660-099-301	PCB Loading - Analogue Section
660-100-301	PCB Loading - Digital Section
660-129-301	PCB Loading - Thumbwheel Switch Mounting

5. HIGH VOLTAGE TESTING

Apply 2KV RMS. between the terminal groups as listed in A & B below for 1 minute.

GROUP A	GROUP B
1,2,3,4	6,7,8,9,10
1,2,6,7,8	3,4,9,10
1,2,3,4,6,7,8,9,10	FRAME

6. CALIBRATION & TEST PROCEDURE

6.1 Disassembly Procedure

To gain access to the non component sides of the analogue and digital circuit boards, the relevant shield boards must be removed. After removing the four side covers, the front and back plates should be removed (there are four lots of four screws). This enables the desired board/rail assembly to be unplugged form the thumbwheel mounting PCB. Care should be exercised during this step to avoid damaging the Ferranti flag mechanism.

6.2 Undervoltage Lockout Calibration

a) Apply auxiliary supply of 82 volts and check that 10 volt and 20 volt rail voltages are within +/- 10 percent of nominal.

b) Monitoring test point 2 on the 660-099 PCB adjust trimpot R18 until the voltage just goes low when the AC voltage is reduced below 55 volts. (The filter switch should be in the “OUT” position).

c) Check that test point 2 switches cleanly as the AC voltage is increased above approximately 65 volts .

6.3 Bandpass Filter Operation

a) Connect a dB (decibel) measuring DVM between IC-1 pin 8 and the +10 volt rail.

b) Check that for 110 volts AC in maximum amplitude on the DVM occurs within the range of 45 - 50 Hz.

OK ☐

c) Check that at 30 Hz and 60 Hz that IC1-8 is more than 7db below amplitude at resonance.

6.4 Oscillator 1 Mhz

Connect a frequency counter to TP3 on PCB 660-100 and check that the frequency is within +/- 50 Hz of 1 Mhz..

OK ☐

6.5 Frequency Measuring Clock Circuitry

a) Connect the oscilloscope to TP4 and trigger input to IC3 pin 2. (set trigger on the -ve going edge).

b) Set “period setting to 20.00 ms, “time” to 0.05 S and “cycles to reset” DIL witch to 4 cycles.

c) Set AC input period to 20.01 ms and check that TP4 waveform is as shown on sheet 18 of the descriptive manual. Note that the observed waveform will jitter due to the non synchronism of AC input and clock waveforms. This waveform is best observed by storing a single sweep on a storage oscilloscope.

d) Adjust the input period to 19.90ms and check that the three or four “hysteresis” pulses disappear for the overfrequency condition. (Output relay dropped out.)

6.6 Period Setting Thumbwheel Switches

a) For the following settings record the input waveform period at which the output relay operates. Adjust frequency downwards (increasing period) to ensure that the hysteresis does not influence the results. Perform the tests at nominal AC and DC voltage levels.

6.6 Period Setting Thumbwheel Switches (Cont)

b) Settings

SETTING	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNITS
11.11	11.10	11.12	11.11		ms
12.22	12.21	12.23	12.22		ms
13.33	13.32	13.34	13.33		ms
14.44	14.43	14.45	14.44		ms
15.55	15.54	15.56	15.55		ms
16.66	16.65	16.67	16.66		ms
17.77	17.76	17.78	17.77		ms
18.88	18.87	18.89	18.88		ms
19.99	19.98	20.00	19.99		ms
20.00	19.99	20.01	20.00		ms

6.7 Timer Logic Check

Check that when the underfrequency condition is present a 10 ms period waveform appears at TP6 on 660-100 logic PCB.

OK ☐

6.8 Timer Operational Check

a) Adjust input frequency to 80Hz (12.5ms period) and set period setting to 10.00ms. Set AC & DC input voltages levels to nominal. Connect timing apparatus “power” contacts between 660-100 SK1 pins 6 & 24. When the contact is closed the 2H33 will effectively be set at 14.00ms and when open the setting will be 10.00ms as indicated.

b) Measure the time interval between the opening of the “power” contact and the operation of the output relay contact. Note that the observed times will be 30 - 40 ms greater than the timer settings due to the operate time of the output relay and the response time of the frequency sensing circuitry.

6.8 Timer Operational Check (Cont)

c) Record times for the following time settings.

SETTING	MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNIT
0.11	0.12	0.16	0.14		SEC
1.22	1.23	1.27	1.25		SEC
2.33	2.34	2.38	2.36		SEC
3.44	3.45	3.49	3.47		SEC
4.55	4.56	4.60	4.58		SEC
5.66	5.67	5.71	5.69		SEC
6.77	6.78	6.82	6.80		SEC
7.88	7.89	7.93	7.91		SEC
8.99	9.00	9.04	9.02		SEC
9.00	9.01	9.05	9.03		SEC

6.9 Cycles to Rest Timer

a) Adjust input frequency to 50 Hz and set period setting to 15 ms. Set timer to 1.00 sec. Connect "power "contact of the timing apparatus between R25 - D11 junction and SK1 pin 27 (on 660-100 PCB). The number of cycles to reset the timer will be the time interval between closure of the "power" contact and the dropout of the out put relay.

b) Set "cycles to reset" DIL switch to 0111 (7 cycles) and record the time.

MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNIT
135	165	150		ms

c) Set "cycles to reset "DIL switch to 1000 (8 cycles) and record time.

MINIMUM	MAXIMUM	NOMINAL	ACTUAL	UNIT
153	188	170		ms

7. GENERAL & FUNCTIONAL

Check that the relay is electrically sound and mechanically robust as per Standard Inspection & Test Schedule 903-000-026

PASS

TESTED BY :_____ DATE :_____

8. CONNECTION DIAGRAM